ANNALS OF SURGERY

VOL. XLIV AUGUST, 1906 No. 2

ORIGINAL MEMOIRS.

ON THE USE OF THE MASLAND SAW FOR OPENING THE CRANIAL VAULT.[1]

BY H. C. MASLAND, M.D.,

OF PHILADELPHIA.

ABOUT one year ago when we first presented before The County Medical Society a new cranial saw, utilizing the power-driven circular saw principle, we felt that the ideas involved and the practical applicability were assured.

Since then we have studied carefully the details of construction so as to produce an instrument thoroughly reliable under all circumstances. The only change made in the saw itself has been to increase the diameter of the circular saw, thereby insuring ability to cut through the thickest skull that might be encountered.

The motor is a sixth horse-power, which has been demonstrated strong enough to drive the saw with perfect ease through the hardest bone.

The flexible cable has been made stronger. It is strong enough to stop the motor without injury to the physical condition of either motor or cable.

It will be seen that a motor ample for any demand of power required, and a cable strong enough to drive the saw with certainty and steadiness through the hardest bone, and yet stronger than the motor itself, secures a reliability of mechanism above every requirement.

---

[1] Read before the Philadelphia Academy of Surgery, April 2, 1906.

The saw is so simple in construction that it can hardly get out of order. The chief necessity is to see that the bearing of the saw shaft is lubricated with a sterile oil. This is done by dropping, as needed, oil in the oil-hole provided at the side of the bearing.

It is appreciated that this instrument opens the skull with a smaller waste of bone-tissue than any other instrument yet devised. The width of section, but one millimeter, and the bevelled cut, permits the replacement of the bone flap on a firm shelf with insignificant sinking of the flap; securing, in other words, a postoperative condition as substantial as before the skull was cut.

We have demonstrated that the skull can be entered with this instrument by either of two methods of operation, each of which has certain advantages which will recommend the one or the other to different operators. The plan of operation depends upon whether one prefers the inside or the outside guard.

In my former paper, I advocated the use of the outside guard. This method does not require the making of any preliminary openings. The osteoplastic flap is, preferably, four-sided, with the shortest side at the basal portion of the skull. This side is to be left uncut for the retention of the vitality of the flap. With a scalpel the flap is outlined in the soft tissue and the tissue cut to the bone surface.

Leaving the flap adherent to its underlying bone, the tissue on the outer side of the incision is dissected away to allow the easy access of the saw. The guard is then set for a depth that we are reasonably sure will not penetrate the thickness of the skull. The saw is always held with the cable side overhanging the flap. This permits a better observation of the section and makes more easy the bevelling of the incision through the bone. After the first cut, the incision is percussed with a bone-sounder which I have devised for the purpose (Fig. 3). A trained ear can learn

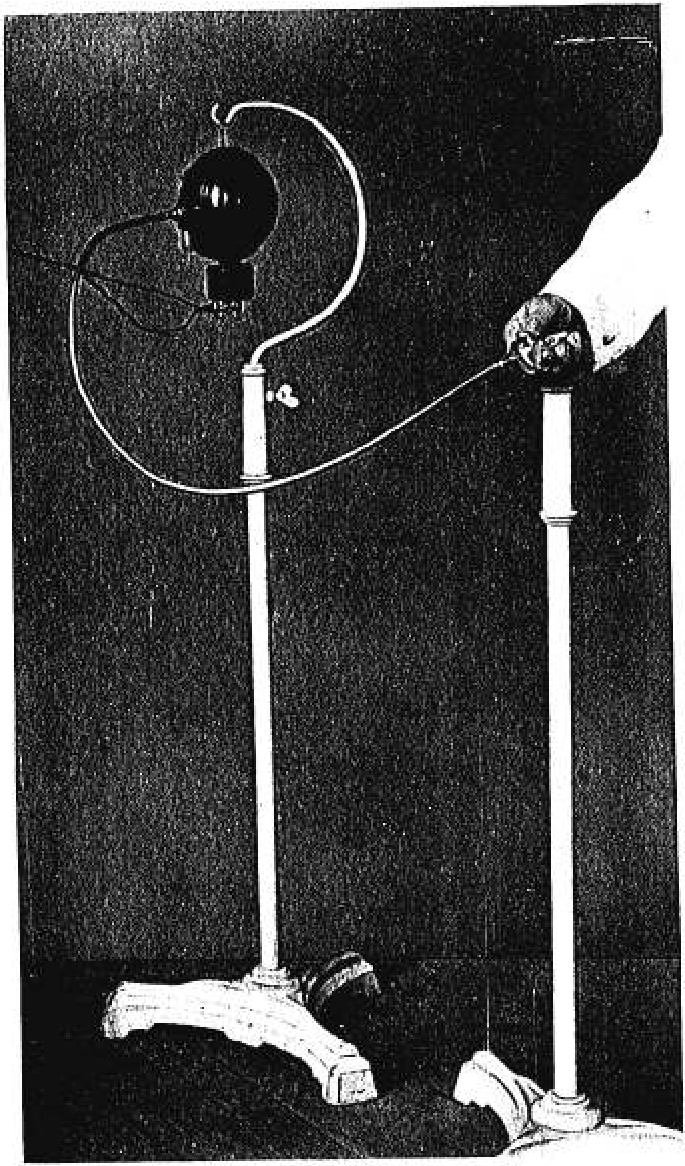

FIG. 1.

from this the relative thickness of the uncut bone. According to one's judgment the guard can then be set coarse or fine. It is possible to set the guard for a difference of one one-hundredth of an inch. Naturally the skill of the operator is called in play in making the final incision through the skull to protect the dura. Only the exercise of undue haste would result in injury to the brain-tissue. After completing the bone sections, soft-tempered steel chisels are inserted in the cut bone at opposite sides of the flap. Springing the flap up with these chisels the remaining short side is broken and the vitality of the flap thus preserved.

It will be seen that the chief problem involved in the use of this saw is to make the section without injury to the subjacent dura. The saw, rotating 1500 or 2000 revolutions per minute, cuts the bone with practically no pressure on the part of the operator. As to the mere cutting of the bone the question of time is eliminated. The greatest care, however, should be exercised in the final stages of the section. It is true that the tactile sense with this instrument is preserved, and surgeons have expressed the opinion that they could tell when they have entered the skull cavity without the use of the guard. I would advise, however, the taking the time with finely-graded adjustments of the guard to prevent injury to a dura intimately attached to the bone.

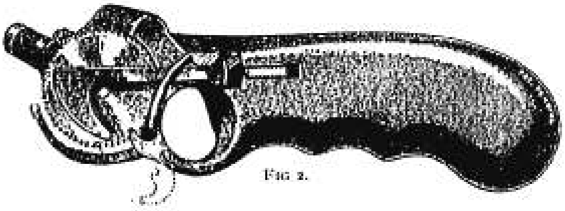

FIG. 2.

FIG. 3.

In my judgment the chief necessity for this care is to obviate hæmorrhage by cutting a dural vessel. True it is preferable to cut the dura subsequently inside the line of the bone incision to facilitate suturing, but the only ill effect arising from simple cutting of the dura by the saw would be the more troublesome subsequent suturing. Hernia cerebri considering the perfect bony support, is impossible.

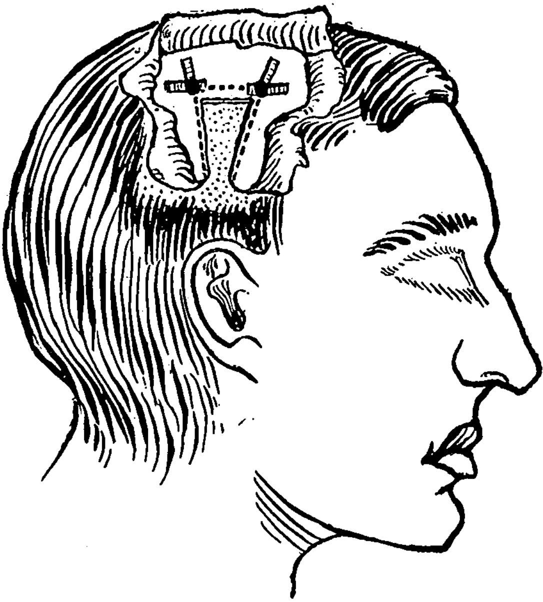

FIG. 4.

It is evident that this instrument, notwithstanding its ability to make a flap superior to all others, must still be able to cut the bone with as little or less injury to the sublying tissues than the best of the others, to entitle it to recognition as being distinctly superior.

The method just described will accomplish this better than any other instrument yet devised with the exception of the Cryer drill. I believe however that with the use of the inside guard on my saw, the dura can be protected from injury with absolute certainty. Using this method the outside guard is discarded. The skin section is made as before mentioned. At the two superior angles of the flap, preliminary openings are made about 3-16 of an inch in diameter, the guard, detached, is then entered in the opening and the dura pressed away from the inner table of the skull. The saw is now used to cut two grooves in the bone chiefly to the outer side of the opening and almost through the bone. (Fig. 4.) These cuts are made in the lines of the intended bone sections. They permit the entry of the guard in a more oblique manner. The shaft of the guard, now attached to the saw, occupies this groove and is supported by its sides. The idea of this groove is to give the saw more room so that it may cut the more easily the bone at the side of the opening. The guard is now kept by the pressure of the thumb on the handle arm in constant contact with the inner wall of the skull, and the incision is advanced. It will be noticed that the guard, to prevent its own destruction, does not come in immediate contact with the teeth of the saw. As a result of this, a thin section of the bone on the inner table of the skull may remain uncut. So soon as the handle-arm of the guard presses upward this condition is in all likelihood present. The advance of the saw is immediately checked, then by pressing the handle of the saw downward, practically rotating it downward with the guard-tip as the pivotal point, the guard sinks deeper and presses the dura away, the saw also sinks deeper and cuts through this remaining portion. The further progress of the incision is then pursued. Starting on a new line of incision the guard is adjusted in the opening and this side of the flap cut as before.

It is always to be borne in mind that when the handle-arm of the guard rises up against the thumb, the advance of the incision should be checked, and the reason for this movement of the guard ascertained. If we find that the bone has been cut through, then it may be an internal ridge of bone or an adherent dura giving the trouble. Should it be a ridge the only care is to have the guard advance over and past it without deflecting into the deeper tissues. This should give no special trouble. It may be that the dura resists the detachment by the guard. Should this occur it is better to detach the guard from the saw, and using it as a blunt dissector coax the dura away from the bone as far as the guard can be advanced. The saw is then attached and this portion of the bone divided. This process can be repeated as often as necessary. The essence of careful surgery would recommend this as the absolute method of preventing injury to the underlying tissues.

I am confident that the plan of operation I have outlined, which takes longer to tell than to perform, rêmoves with certainty the liability of injuring the dura or producing serious hæmorrhage. The bleeding that would ensue would be the usual bone bleeding that is expected.

The subsequent breaking of the undivided side of the bone-flap is performed as before, and is familiar to all.

In claiming for this instrument a superiority as to method and results over all other instruments used for the purpose, it may be well to mention some of the chief disadvantages of these instruments and show wherein this new one excels.

The hand trephine, descended to us from remote antiquity, requires but little notice. Its tendency with the best of care to injure the dura or even the brain-tissue is known to all. It destroys the vitality of the button of bone, and makes an opening restricted to the fixed diameter of the trephine in hand. It is tiresome, dirty and practically abandoned by the advanced cranial surgeons.

The Stalwagen trephine is a considerable improvement, but it is still possessed of many of the defects of the original trephine. It is very tiring to the hand and is easily capable of injuring the dura and causing serious hæmorrhage. It does not permit of a bevel edge and the sustaining shelf so desirable. There is a tendency to jam consequent upon and inseparable from its mechanical construction. This jamming is intensified as the cut becomes deeper. Subsequent enlargment of the original opening must be made with the bone forceps, with a resultant waste of bone.

The mallet and chisel are probably used by more of the best surgeons to-day than any other instruments. Yet after all such weapons are a shock to us, more to the laity and most to the unfortunate victim requiring its use. The charge has some merit that more perfect instruments should have been devised long ago. Yet we are aware that the mallet and chisel have many elements of superiority. They permit of sections of any desired shape and size, and they permit of reposition of the bone-flap upon supporting spicules of the surrounding bone, giving results possibly attained by no other instrument heretofore used. The objections to the chisel are the length of time required to make the bone-flap, the concussion that undoubtedly does add to the risks of the patient, and the great likelihood of the bone suddenly giving away and the skull contents being injured. The difficulties of the mallet and chisel increase many fold with an unusually thick or hard skull. While a surgeon with much practice may become high-master in the use of the mallet and chisel, yet all appreciate that its use generally is fraught with many perils.

The foregoing instruments have the advantage of cheapness and that they are dependent upon no mechanism restricting the wide range of their usefulness.

The Cryer instrument, devised by Dr. Cryer of this city, is a departure from the principles of its predecessors. It receives its cutting power from a mechanical source external to the operator. A side-cutting drill is used to make the section in the bone, and an inside guard is provided that protects the dura from all possible injury. The flap section is made large or small at the will of the operator. Celerity is attained, hæmorrhage is avoided, and a vital flap is secured. Some of its disadvantages are that it makes a wide incision of the bone, not permitting the shelf support so desirable. The drill is necessarily slender, to make a reasonably narrow incision. Inasmuch as the force is applied against the long diameter of the drill, the point of least resistance, the drill must not be pressed too hard against the bone or it will break.

The inside guard prevents the instrument being withdrawn till it is carried back to the original opening. This may present a very considerable disadvantage under certain circumstances. The operator's hand must constantly occupy a constrained position in keeping the guard up against the inner wall of the skull.

An instrument devised by Alfred Sykes, of Yorkshire, is a modification of the Cryer instrument having a handle at right angles to the drill-shaft. This instrument, of which I have seen the illustration only, possibly relieves this uncomfortable position of the hand, though I would not judge it as useful as the Cryer instrument in other respects.

While the Cryer instrument can be sterilized, its structural parts cannot be dissociated by an amateur for thorough cleansing purposes.

The Doyen saw utilizes the circular saw but without an efficient guard to adequately control the depth of cut. Its construction does not permit that steadiness and fine control which is an essential in this class of instruments. I am informed by Prof. Keen that as he saw it used it was no more rapid than he found possible with his mallet and chisel.

The Doyen small saw is a Hey saw with the addition of an adjustable guard. It is subject still to practically all the disadvantages of the Hey Saw.

In the Sudeck instrument the circular saw is placed between the handles. The instrument is grasped as a woman would grasp the handles of a rolling-pin. It does not have an adjustable guard. While by no means devoid of merit, yet its construction prevents the utilization of many of the principles which are necessary to make a thoroughly practical saw. The defects of the foregoing instruments are apparently overcome by my new saw.

The osteoplastic flap can be made any size or shape.

The time required to make the cut is as short as can possibly be hoped for.

When using the outside guard, it is impossible to cut deeper than the depth set by the guard.

The likelihood of hæmorrhage, particularly with the use of the inside guard, is obviated.

The incision is but one millimeter in width, whatever the thickness of the skull.

Perfect bony support for the reposed flap is secured to a degree not heretofore obtained, giving perfect bone protection to the brain.

The instrument gives no vibration, a thoroughly comfortable grasp to the hand, and occasions no tension of the hand, permitting a full utilization of the sense of touch.

The inside guard, when used, can be detached immediately and the saw at once withdrawn from the cut.

The saw is so simply constructed that by observing a few simple rules no mishap in its working should occur. Further the construction is so simple that a nurse or a amateur can take it apart and cleanse it thoroughly, replacing the parts without trouble.

It will no doubt take time for the profession to accustom itself to this new instrument, but I firmly believe that a utilization of the principles here involved will open up a new field in successful and more perfect surgery of the brain.